

Title:

Capacity building of local governmental and non-governmental organizations on environmental hygiene through a community-based training workshop program

Running head:

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Mayumi Ohnishi¹, RN, MPH, Ph.D. Keiko Nakamura², MD, Ph.D.

¹ Department of Nursing, School of Health Sciences, Nagasaki University

² Department of International Health & Medicine, Graduate School of Tokyo Medical and Dental University

Corresponding author

Dr. Mayumi Ohnishi

Department of Nursing, School of Health Sciences

Nagasaki University

1-7-1 Sakamoto, Nagasaki-shi, Nagasaki-ken 852-8520 Japan

Phone & Fax: +81-95-819-7943

e-mail: mohnishi@nagasaki-u.ac.jp

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Abstract

This study was performed to evaluate the feasibility of a joint community-based environmental hygiene program in partnership between local governmental and non-governmental organizations with participants from different professional backgrounds, including inspectors of environmental sanitation and community leaders in Lagos, Nigeria, because no suitable collaboration had been implemented in this area.

Qualitative and quantitative evaluations were performed with regard to malaria prevention and community-based environmental hygiene training workshops in three local communities in Lagos, Nigeria. Qualitative evaluation revealed the importance of establishment of close partnerships between local governmental and non-governmental organizations, and possible community participation in the program for its success. A total of 36 participants completed pre- and follow-up assessment before and after the three-day training course. The mean pre-test score was 27.8 ± 13.9 (mean \pm standard deviation), while that of the follow-up test was 57.1 ± 17.8 . This mean gain of

29.3±17.4 in the score represented a significant improvement ($P<0.001$). The objective of the training workshop, *i.e.*, to implement the community-based environmental hygiene program, was successfully achieved. The training workshop also established good relations between governmental and non-governmental organizations with different professional backgrounds, and demonstrated the potential for sustained collaboration.

INTRODUCTION

Nigeria, with a population of 130 million, is the largest country in Sub-Saharan Africa. This country is undergoing rapid urbanization, especially in the former capital, Lagos. Malaria is a major cause of both morbidity and mortality, accounting for the deaths of 798,000 children and 4,500 women in Nigeria every year. Only 5% of children under the age of five and 3% of pregnant women use an insecticide-treated bed net (ITN), even though 30% and 11% of child and maternal mortality are due to malaria, respectively. Fifty percent of the total population in the country suffers from malaria at least once a year; this has a marked economic impact, reducing the gross national product of Nigeria by 1% (The National Primary Health Care Development Agency, 2001).

Community Partners for Health (CPH) is an organization established to improve participatory community health programs in Lagos State, Nigeria, through Basic Support for Institutionalizing Child Survival (BASICS)—a project funded by the United States Agency for International Development (USAID). CPH provides basic health services, including primary care and family planning counseling, to people in the community. CPH aims to strengthen their capability to promote malaria prevention

to tackle this major health problem in the community.

A number of previous studies have demonstrated the effectiveness of the distribution and appropriate use of ITN, but crucial issues regarding sustainability of the implementation of such programs remain to be resolved (Fraser-Hurt and Lyimo, 1998; Guyatt *et al.*, 2002; Njama *et al.*, 2003). In addition, environmental hygiene control programs are also required at the community level (Matwally *et al.*, 2006).

A training workshop was provided for both local governmental and community-based environmental health workers with different professional backgrounds, including inspectors of environmental sanitation and community leaders, with collaboration between local government and non-governmental organizations, such as CPH, to create a joint system to implement and monitor the community-based program on malaria prevention and environmental hygiene by both organizations. The objective of the present study was to evaluate the capacity development and feasibility to realize a community-based environmental hygiene program both qualitatively and quantitatively through the coordination process of a training workshop.

METHODS

Study area

The present study was performed in July 2003 in Lagos State, Nigeria. CPH acted as part of the community health program during the 1990s in Lagos State. On the other hand, the local government area (LGA) is in charge of community health at the lowest community level from the government side. Both CPH and LGA are located in each local community in which the present study was performed. People in the community determined malaria prevention and improvement of community-based environmental hygiene to be priorities that should be addressed through the activities of three CPHs in Lagos State. The three CPHs established a plan of activities that included the provision of community-based environmental health worker training workshops regarding malaria prevention and environmental hygiene.

Problem statement

Before implementing the community-based environmental hygiene program, there were complaints from people within community about poor and inefficient performance of the local government, not only within the health sector, but also with

regard to general management and performance of the other sectors. In general, the private sector, including non-governmental organizations, had close ties with local people within the community because the governmental sector could not resolve community problems, and the government sector left some problems to the community to solve itself. For example, the local government started to reconstruct a drainage canal, but construction was stopped before completion because of political issues and the bulldozer was left in the community as scrap. Therefore, there was little confidence within the community regarding the government sector.

On the other hand, although the private sector works together with local people, the government sector should fulfill their role, such as regulation, governmental supervision, and management of the program. The prime needs were outlined by non-governmental organizations working closely with the community, such as CPH, to scale-up collaboration between the local government and the private sector, and encourage them to fulfill their respective functions appropriately. The final goal of the training workshop was to work together for effective and efficient problem solving in the community.

Study procedure

A three-day participatory training workshop regarding malaria prevention and community-based environmental hygiene was conducted in each CPH area in July 2003, funded by the Japan International Cooperation Agency (JICA), with the objective of increasing the participants' knowledge and understanding regarding activities important for these health-related topics at the community level. The training workshop was an opportunity for the governmental and non-governmental sectors to work together, which had never happened previously in this area. It was not only important to increase the participants' levels of knowledge and understanding, but also to create appropriate relationships among the various participants and encourage them to sustain an adequate environment in which to work together.

The training workshop was conducted as a joint program by both CPH and LGA. Meetings were held with the Lagos State Government and Lagos Local Government, and they authorized the study and training workshop prior to commencement. A stakeholder meeting was held prior to the training workshop with representatives of the Local Government health and sanitation division, the board members of CPH, and representatives of the local people, such as community-based organizations that were a local business network, local market association, and

women's union. They were informed about the details of the workshop and the role of local people in environmental hygiene after the workshop through the members of the CPH.

Participatory training workshop regarding malaria prevention and community-based environmental hygiene

The participatory training workshop included 3 modules: (1) waste and sewage management at the community level; (2) malaria prevention at the community level, and home care and treatment of malaria; and (3) action plans. “Waste and sewage management at the community level” focused on the impact of environmental hygiene drainage systems by waste and sewage, the relations between environmental hygiene and human health and disease, waste treatment and management, and sewage drainage at the community level. “Malaria prevention and home care at the community level” focused on the causes, prevention—including use and retreatment of ITN with insecticide—and risk signs and symptoms, referral, and home care of malaria sufferers. “Action plans” focused on establishing appropriate action plans for community-based environmental hygiene and malaria prevention by the participants in the training

course. Community participation and community approach methods were emphasized throughout the training workshop.

Qualitative evaluation procedure

Qualitative evaluation was conducted to assess the acceptability, feasibility, and sustainability of a community-based environmental hygiene program with regard to the following points: (1) Political mobilization by LGA and state government; (2) Degree of community participation; (3) Degree of increased awareness of community-based environmental hygiene; (4) Capacity to manage the joint program with LGA and CPH; and (5) Partnership established between LGA and CPH through stakeholder analysis, process of the training workshop, and participatory observation (Box 1). The qualitative evaluation framework was established with reference to feasibility assessment in the project cycle management, which is used as a JICA project management tool.

The proceedings of the meetings with government authorities and stakeholder meetings as well as field notes were used to analyze qualitative data. The data were analyzed inductively according to the qualitative evaluation framework as shown in Box 1 by one of the authors with the assistance of the local JICA project coordinator

who was proficient in the local language of the area, and prepared a narrative summary.

The other author comprehensively reviewed the inductive evaluation process.

Quantitative evaluation procedure

<Subjects >

Six training participants from each CPH were selected as future community-based environmental health workers. They were CPH members and also representatives of community-based organizations, such as the local business network, women's union and others. An additional 6 training participants from each LGA were selected as future collaborators on the activities of the CPH, all of whom were environmental sanitation inspectors.

<Evaluation of knowledge level>

Before and after the training workshop, the training course participants completed pre- and follow-up tests, which included multiple choice, fill-in-the-blanks, true-or-false, and descriptive questions regarding malaria prevention and community-based environmental hygiene. The items examined on the test are shown in Box 2.

Pre- and follow-up test scores were calculated, with a score of 0 representing

the lowest and 100 the highest level of knowledge and understanding. The minimum score for success was 60. The tests were marked by training instructors proficient in both English and the local language, using established criteria of marking. Points were given for each correct answer that demonstrated correct knowledge and understanding regardless of the actual expression and language used.

<Statistical Analysis>

The paired *t*-test was used to determine the significance of changes in level of knowledge regarding malaria prevention and community-based environmental hygiene between pre- and post-test. Differences in improvement between CPH and LGA were analyzed by *t*-test.

Ethical clearance

The Lagos State Government and Lagos Local Government authorized the training workshop and the study prior to commencement. In the stakeholder meeting prior to the training workshop, they approved both the program and study. Informed consent was obtained from all training workshop participants. Permission for publication of the study results was obtained from the Japan International Cooperation Agency.

RESULTS

Qualitative evaluation

Table 1 presents a summary of the qualitative evaluation. The details are presented below along with examples of the opinions of both stakeholders and training workshop participants.

1) Political mobilization by LGA and state government

CPH leaders and key people actively coordinated a joint stakeholder meeting with LGA and CPH, with a coordinator from JICA acting as a mediator.

There were no marked changes in LGA function during the planning and evaluation period of the training workshop. However, each of the LGAs agreed to conduct the joint training workshop, to implement the capabilities obtained through the training workshop in the communities, and to supervise and monitor the impacts of the implementations of these capabilities. The LGA authorities delegated officers in charge of training participation, supervision, and monitoring.

The JICA coordinator adopted a position between the state government of

Lagos and LGAs.

2) Degree of community participation

The CPHs had already established active collaborations and partnerships with community-based organizations, such as local business networks, local markets, and women's unions through the provision of primary health care services, including family planning services. The concept behind the community-based environmental hygiene program was disseminated among local stakeholders prior to implementation of the project based on these established partnerships. The reactions from local stakeholders were positive. The training workshop, performed as part of the community-based environmental hygiene program, was expected to be an opportunity for the training of trainers (TOT), and people in the community were motivated to promote the community-based environmental hygiene program after receiving information regarding TOT. During the training workshop, the local business sector and the community facilitated the provision of venues for training and transportation for the participants.

We can work hard for the community. The problem is there is no continuous support form anybody. If the government does something good, we can feel

more confident in them. We can do everything better ourselves (by stakeholder).

3) Degree of increased awareness regarding community-based environmental hygiene

Maintenance of the environment and hygiene are the highest priorities among people within the community. The community-based environmental hygiene program not only increased awareness of community-based environmental hygiene but also increased the degree of motivation of people within the community to address these issues. Following the local stakeholder meeting regarding the community-based environmental hygiene program, people within the community began organizing a program for rotation of drain cleaning at the community level.

If the government does not serve us, we serve ourselves. We have already worked by ourselves. However, if the government can function adequately for us, it will be fine (by stakeholder).

4) Capacity to manage the joint program with LGA and CPH

The CPH obtained project management skills through previous BASICS activities. Preparation and logistics were operated by CPH members before, during, and after the

training workshop.

The LGA officers recognized the management capacity of the CPH through participation in the training workshop.

It is good to work together. We can work in the same direction. We never had this type of experience before (by participant from CPH and LGA).

5) Partnership established between LGA and CPH

The training workshop was the first step in the establishment of a partnership for the joint program between the LGA and CPH. LGA officers and CPH members gained an understanding of the weaknesses and strengths of each organization through the training workshop.

It is important to have an LGA officer present in the community. Then, people can recognize that LGA is confident (by participant from LGA).

We need supervision and monitoring by the authorities. We need someone who can support us and help when we encounter a problem (by participant from CPH).

Quantitative evaluation

A total of 36 participants—18 from CPH and another 18 from LGA—completed the pre- and follow-up tests. The means and standard deviation of pre- and follow-up test scores were 27.8 ± 13.9 and 57.1 ± 17.8 , respectively, indicating a statistically significant improvement ($P < 0.001$). The median scores of the pre- and follow-up tests were 26.8 and 58.0, respectively. None of the participants achieved at least the minimum score defined as the cut-off for success in the pre-test, and the highest and the lowest scores were 58 and 1, respectively. Fifteen participants, 7 from CPH and 8 from LGA, achieved at least the minimum score for success in the follow-up test, and the highest and the lowest scores were 92 and 17, respectively. This mean gain of 29.3 ± 17.4 in the score represented a significant improvement of 105.4% ($P < 0.001$). Two participants achieved lower scores in the follow-up test than in the pre-test.

Table 2 shows the results of the pre- and follow-up tests according to background organizational qualifications. The pre-test scores according to background organizational qualifications were 32.0 ± 15.0 (mean \pm SD) and 23.6 ± 11.7 in the participants from CPH and in those from LGA, respectively ($P = 0.068$). The follow-up test score in the participants from CPH was 55.9 ± 16.8 , and that in the participants from LGA was 58.2 ± 19.2 ($P = 0.714$). Despite the higher pre-test scores by the CPH

participants as compared with those from the LGA, the difference was not statistically significant. The LGA participants showed higher follow-up test scores than the CPH participants, although the difference was not statistically significant. CPH and LGA participants showed increases from pre- to post-test scores of 23.9 ± 15.0 and 34.6 ± 18.1 , respectively, and the difference between groups was not significant ($P=0.066$).

Sixty-two percent of the full score was devoted to questions regarding community-based environmental hygiene. The CPH participants (20.8 ± 10.1) showed higher scores in the pre-test than the LGA participants (15.1 ± 7.5), and the difference was statistically significant ($P < 0.01$). However, in the follow-up test, there was no statistically significant difference between the two groups, although the LGA participants showed an increase of 18.7 ± 12.0 , while the CPH participants showed an increase of 12.4 ± 11.3 as compared with the respective pre-test scores.

DISCUSSION

The qualitative evaluation performed in the present study represented the first participation of the LGA and CPH in the same training workshop. The results indicated that the LGA, CPH, and people from the community showed positive reactions and motivation with regard to participation in the community-based environmental hygiene program.

The quantitative evaluation indicated that the training workshop improved the level of knowledge of the participants with regard to malaria prevention and environmental hygiene required to develop a community-based environmental hygiene program. On the other hand, even the LGA officers who work as inspectors of environmental sanitation were shown to have insufficient knowledge regarding environmental hygiene to work at the community level in the pre-test provided before participating in the training workshop. The training workshop contributed substantially to improvement of the competency of LGA officers.

The training workshop reported here represented the first venture performed jointly by governmental and non-governmental sectors at the community level in Lagos State, Nigeria. During the training, the dynamics of performance of both the

CPH and LGA groups functioned to provide mutual stimulation, demonstrating the advantages of the cooperative involvement of the two groups. Pavia *et al.* reported the effectiveness of training with collaboration between non-governmental organizations and universities (Pavia *et al.*, 2002). It is important to share roles and capabilities of personnel from different sectors, but who work together or in the same field in a collaborative manner. This type of joint training workshop will help to establish and maintain good synergy among different sectors.

The participants' knowledge level was lower than anticipated before conducting the pre-test. At the planning stage of the training workshop, the authors predicted that modules (1) and (2), which were focused more toward acquiring knowledge, would be opportunities to review the participants' existing knowledge level and to share this understanding among the participants. This process, such as updating their knowledge regarding malaria treatment and ITN use and management, would be practical when they perform their duties as environmental health workers. However, most of the participants were not capable of performing their role as environmental health workers appropriately. Therefore, it was necessary to obtain new knowledge and understanding of the relevant issues. The contents of the training workshop itself, even basic knowledge on the topics of the training, were important as new knowledge for

the participants, and stimulated them to discuss their experiences in the community.

One of the topics discussed in the training workshop was self-treatment of malaria. Self-treatment of malaria is crucial (Ajayi *et al.*, 2008), and a number of studies have been performed to improve the quality of malaria treatment at the community level, such as education of mothers and training of shopkeepers who sell anti-malaria drugs regarding their appropriate use (Kidane *et al.*, 2000; Marsh *et al.*, 1999). The participants from CPH in the present study included leaders of community markets and women's unions, who act as powerful communicators at the community level. Efforts to increase peer pressure, such as pressure from neighbors regarding home treatment of malaria based on appropriate knowledge, are potentially beneficial approaches at the community level.

The other topic in which there was interest in increasing awareness within the community was ITN use and management. The costs of buying and retreating ITNs with insecticide are major obstacles preventing their appropriate use in the community, especially in poor areas (Onwujekwe *et al.*, 2000). However, this also provides an opportunity for neighbors to work together to obtain and use insecticide according to an appropriate schedule. Peer pressure will play a major role in increasing people's motivation toward the use of ITN, and continuous leadership based on life at the

community level should function to maintain such motivation.

The scores for two participants, one from CPH and the other from LGA, were lower in the follow-up test than in the pre-test. It is possible that these participants were confused between the new knowledge gained in the workshop and their existing knowledge, and were overconfident after the training course. The range of knowledge level also varied in the pre- and follow-up tests. The course program and facilitation methods should be reorganized for future opportunities to demonstrate higher educational achievement, even though most of the participants increased their knowledge level. The adult learning process should be considered, and prior needs assessment of each participant would be helpful to adequately adjust the training contents for the background situation of the participant.

The main objective of the training workshop was to increase the level of knowledge regarding malaria prevention and environmental sanitation among candidate community-based environmental health workers. However, the training workshop was also performed to establish good relationships and solidarity between the LGA and non-governmental organizations, such as CPH, to encourage them to work together despite their different professional backgrounds, such as local governmental inspectors of environmental sanitation, community leaders, and others,

in implementing a community-based environmental hygiene program. That is, the former was a vertical objective of the training workshop, while the latter was a horizontal objective. When both objectives are accomplished, the project can be considered to have been implemented well. At the same time, the program's goal was for the participants to learn from others with different organizational and professional backgrounds to complement the learning process. The participants in the training program including community leaders shared the same objectives and knowledge regarding the community-based environmental hygiene program. Their experiences in the training workshop can be a source of sustainable partnerships between governmental and non-governmental organizations including local people.

The next stage is to disseminate the knowledge obtained in the training workshop among the community. A participatory community-based activity is a potential approach to sustain the program wherein participants pass on the knowledge obtained by teaching their neighbors (Ramos *et al.*, 2001; McDuff, 2001). A continuous comprehensive approach for the prevention of malaria at the community level is necessary. At the same time, the local people can come to have greater trust in the governmental sector through the joint program with a partnership between the governmental and non-governmental sectors. Public health activities should be

mobilized with participation of stakeholders and local people at a grassroots level, including those with diverse backgrounds, and not only medical and health professionals. Further studies are required to monitor and evaluate the impact of the implementation of the program described here.

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REFERENCES

Ajayi I. O., Falade C. O., Olley B. O., Yusuf B., Gbotosho S., Iyiola T., Olaniyan O., Happi C., Munguti K. & Pagnoni F. (2008) A qualitative study of the feasibility and community perception on the effectiveness of artemether-lumefantrine use in the context of home management of malaria in south-west Nigeria. *BMC Health Services Research*, 8, 119.

Fraser-Hurt N. & Lyimo E. O. K. (1998). Insecticide-treated nets and treatment service: a trial using public and private sector channels in rural United Republic of Tanzania. *Bulletin of the World Health Organization*, 76, 507-615.

Guyatt, H. L., Gotink, M. H., Ochala, Sam A. & Snow, R. W. (2002). Free bednets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery. *Tropical Medicine and International Health*, 7, 409-420.

Kidane, G. & Morrow, R. H. (2000). Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomized trial. *The Lancet*, 356, 550-555.

Marsh, V. M., Mutemi, W. M., Muteri, J., Haaland, A., Watkins, W.M., Otieno, G. & Marsh, K. (1999). Changing home treatment of childhood fevers by training shop keepers in rural Kenya. *Tropical Medicine and International Health*, 4, 383-389.

McDuff, M. D. (2001). Building the capacity of grassroots conservation organizations to conduct participatory evaluation. *Environmental Management*, 7, 715-727.

Matwally, A. M., Ibrahim N. A., Saad A. & Abu el-Ela M. H. (2006). Improving the roles of rural women in health and environmental issues. *International Journal of Environmental Health Research*, 16, 133-44.

Njama, D., Dorsey, G., Guwatudde, D., Kigonya, K., Greenhouse, B., Musisi, S., & Moses R. K. (2003). Urban malaria: primary caregivers' knowledge, attitude, practice and predictors of malaria incidence in a cohort of Ugandan children. *Tropical Medicine and International Health*, 8, 685-692.

Onwujekwe, O., Shu, E., Chima, R., Onyido, A. & Okonkwo, P. (2000). Willingness to

pay for the retreatment of mosquito nets with insecticide in four communities of south-eastern Nigeria. *Tropical Medicine and International Health*, 5, 370-376.

Pavia, V., Ayres, J. R., Buchalla, C. M. & Hearst, N. (2002). Building partnership to respond to HIV/AIDS: non-governmental organizations and universities. *AIDS*, 16(suppl 3), S76-S82.

Ramos, I. N., May, M. & Ramos, K. S. (2001). Environmental health training of promotoras in colonias along the Texas-Mexico border. *American Journal of Public Health*, 91, 568-570.

The National Primary Health Care Development Agency. (2001). The status of primary health care in Nigeria: Report of a needs assessment survey. Abuja: The National Primary Health Care Development Agency.

Box 1. Qualitative evaluation framework

	Acceptability	Feasibility	Sustainability
(1) Political mobilization by LGA and state government	How they accepted the community-based environmental sanitation program.	How they made a commitment to the program.	What level of potential they have in sustaining their commitment into the program.
(2) Degree of community participation	What level of acceptance was demonstrated to participate in the program.	What level of community participation was demonstrated to contribute to the program.	What level of potential local people have in sustaining their participation in the program.
(3) Degree of increased awareness of community-based environmental hygiene	How the program was accepted by stakeholders and local people.	How they understood and were aware of the program.	How they can maintain their motivation to sustain their contribution to the program
(4) Capacity to manage the joint program with LGA and CPH	How they accepted performance of the joint program.	How they performed in the joint program.	What level of potential they have in sustaining a collaboration between LGA and CPH.
(5) Partnership established between LGA and CPH	How they accepted establishment of a partnership between LGA and CPH.	How they showed partnership during the program.	What level of potential they have in sustaining the partnership.

Box 2. Items examined in pre- and follow-up tests

1. Symptoms of complicated malaria.
2. Symptoms of simple malaria.
3. Types of malaria control measure.
4. Ways of preventing malaria.
5. Differences between treated and non-treated bed nets.
6. Tepid sponging.
7. The correct dosage of anti-malaria drugs.
 - 1) Children (1–3 years old).
 - 2) Adults.
8. The referral process.
9. Definition of environment
- 10-a) Negative ways man affects the environment.
- 10-b) Positive ways man affects the environment.
- 11-a) Negative ways the environment affects man.
- 11-b) Positive ways the environment affects man.
- 12). Definition of drainage system.
13. Definition of solid waste.
14. Types of drainage system.
15. Five human ways of generating waste.
16. Ways of preventing waste at the individual and household (family) levels.
17. Ways of managing waste generated at the community level.
18. Diseases related to drainage and solid waste.
19. Definition of community participation and mobilization.
20. Benefits of community participation.
21. Roles of the individual in drainage and solid waste control and management.
22. Roles of the community in drainage and solid waste management.
23. Various habitats or breeding sites of mosquitoes.
24. Measures for controlling mosquitoes.

Table 1. Results of the qualitative evaluation

	Acceptability	Feasibility	Sustainability
(1) Political mobilization by LGA and state government	Governmental sectors welcomed the joint program with non-governmental organizations. There were no obstacles to obtain their agreement and participation.	LGA sent their officers to participate in the program, even though it was not mandated from the upper level governmental sector.	State government agreed to give continuous support to the community-based environmental hygiene program.
(2) Degree of community participation	Stakeholder and local people welcomed the establishment of a close relation between LGA and CPH, and initiation of the program.	Training workshop venues were provided by members of the local business network, who were happy to be involved in the program.	If the government sector maintains support and close relations with the community, the local people will retain confidence in the governmental sector and their willingness to become involved in the community development.
(3) Degree of increased awareness of community-based environmental hygiene	The need for improvement of community-based environmental hygiene was raised by the community.	The stakeholders and local people were encouraged through the training workshop.	Some of the community-based organizations and local people started monthly clean-up operations of their neighborhood drainage systems. They were encouraged to disseminate the knowledge gained in the program to the local community.
(4) Capacity to manage the joint program with LGA and CPH	Initially, a mediator such as program coordinator and training facilitator should pay attention to creating a good atmosphere, but after some time there was no strain between LGA and CPH.	The participants helped each other based on their respective strong points.	At the beginning of the implementation of the program, CPH should have an initiative to facilitate going to the local people with LGA officers, because CPH had close ties with the community and local people based on their experience.
(5) Partnership established between LGA and CPH	LGA and CPH participants were not friendly at the beginning of the training workshop, but after some discussion and sharing of experiences they interacted more closely.	LGA participants made an appropriate action plan, even though CPH participants were more active at the beginning of the training workshop.	At the community-based environmental health workers level, both CPH and LGA can work together. However, continuous authorization from the state and local government was required to sustain such partnerships.

Table 2. Results of pre- and follow-up tests regarding malaria prevention and environmental sanitation among training participants (*n*=36)

	Pre-test			Follow-up test			Gain			Difference in score between pre- and follow-up tests (<i>P</i> value; paired <i>t</i> -test)	
	(mean±SD)	median	range	(mean±SD)	median	range	(mean±SD)	median	range		
All questions (full score = 100)											
CPH (<i>n</i> =18)	32.0±15.0	29	8–58	55.9±16.8	56	26–92	23.9±15.4	23	-4–52	***	
LGA (<i>n</i> =18)	23.6±11.7	25	1–50	58.2±19.2	60	17–87	34.6±18.1	35	-14–62	***	
Questions regarding malaria (full score = 38)											
CPH (<i>n</i> =18)	11.3±15.0	12	1–26	22.8±7.3	24	8–36	11.5±6.2	12	1–21	***	
LGA (<i>n</i> =18)	8.4±4.9	9	1–17	24.4±7.3	26	10–36	15.9±7.5	17	-6–30	***	
Questions regarding environmental sanitation (full score = 62)											
CPH (<i>n</i> =18)	20.8±10.1	}##	19	4–38	33.2±10.9	32	18–56	12.4±11.3	14	-9–33	***
LGA (<i>n</i> =18)	15.1±7.5		16	0–25	33.8±12.4	35	6–51	18.7±12.0	21	-8–41	***

##: *P*<0.01 Comparison of means of two categories (*t*-test).***: *P*<0.001 Comparison of means of pre- and follow-up tests (paired *t*-test).